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SWAN LAKE, SULLIVAN COUNTY, NEW YORK, EPA REGION II

Pacific Northwest Environmental Research Laboratory

Prepared for:

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December 1974

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16. ABSTRACT

Annual total phosphorus and total nitrogen loadings to the lake were estimated and subdivided according to either point or non-point source origin. An assessment of the lake's trophic condition and limiting nutrient is also provided. All data collected by the U.S.E.P.A. National Eutrophication Survey during the one year study of the lake and its tributaries are included in the report.

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REPORT
ON
SWAN LAKE
SULLIVAN COUNTY
NEW YORK

EPA REGION II

WORKING PAPER No. 171

WITH THE COOPERATION OF THE

NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION

AND THE

NEW YORK NATIONAL GUARD

DECEMBER, 1974

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FOREWORD

The National Eutrophication Survey was initiated in 1972 in response to an Administration commitment to investigate the nationwide threat of accelerated eutrophication to fresh water lakes and reservoirs.

OBJECTIVES

The Survey was designed to develop, in conjunction with state environmental agencies, information on nutrient sources, concentrations, and impact on selected freshwater lakes as a basis for formulating comprehensive and coordinated national, regional, and state management practices relating to point-source discharge reduction and non-point source pollution abatement in lake watersheds.

ANALYTIC APPROACH

The mathematical and statistical procedures selected for the Survey's eutrophication analysis are based on related concepts that:

a. A generalized representation or model relating sources, concentrations, and impacts can be constructed.

b. By applying measurements of relevant parameters associated with lake degradation, the generalized model can be transformed into an operational representation of a lake, its drainage basin, and related nutrients.

c. With such a transformation, an assessment of the potential for eutrophication control can be made.

LAKE ANALYSIS

In this report, the first stage of evaluation of lake and watershed data collected from the study lake and its drainage basin is documented. The report is formatted to provide state environmental agencies with specific information for basin planning [§303(e)], water quality criteria/standards review [§303(c)], clean lakes [§314(a,b)], and water quality monitoring [§106 and §305(b)] activities mandated by the Federal Water Pollution Control Act Amendments of 1972.

Beyond the single lake analysis, broader based correlations between nutrient concentrations (and loading) and trophic condition are being made to advance the rationale and data base for refinement of nutrient water quality criteria for the Nation's fresh water lakes. Likewise, multivariate evaluations for the relationships between land use, nutrient export, and trophic condition, by lake class or use, are being developed to assist in the formulation of planning guidelines and policies by EPA and to augment plans implementation by the states.

ACKNOWLEDGMENT

The staff of the National Eutrophication Survey (Office of Research & Development, U. S. Environmental Protection Agency) expresses sincere appreciation to the New York Department of Environmental Conservation for professional involvement and to the New York National Guard for conducting the tributary sampling phase of the Survey.

Henry L. Diamond, Commissioner of the New York Department of Environmental Conservation, and Leo J. Hetling, Director, and Italo G. Carcich, Senior Sanitary Engineer, Environmental Quality Research, Department of Environmental Conservation, provided invaluable lake documentation and counsel during the Survey.

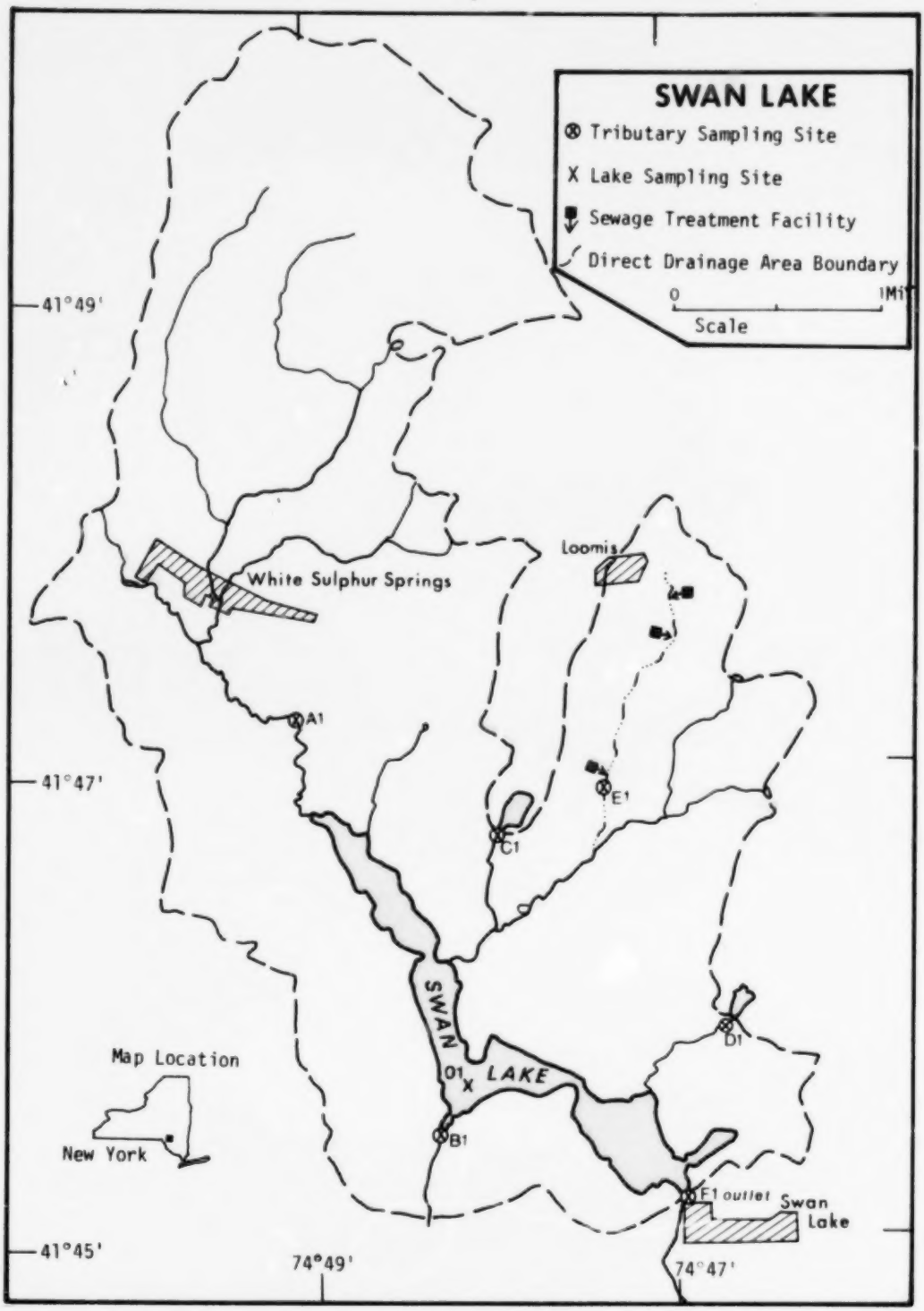
Major General John C. Baker, the Adjutant General of New York, and Project Officer Lieutenant Colonel Fred Peters, who directed the volunteer efforts of the New York National Guardsmen, are also gratefully acknowledged for their assistance to the Survey.

NATIONAL EUTROPHICATION SURVEY

STUDY LAKES

STATE OF NEW YORK

LAKE NAME	COUNTY
Allegheny Reservoir	Cattaraugas, NY; McLean, Warren, PA
Black	St. Lawrence
Canadaigua	Ontario
Cannonsville	Delaware
Carry Falls	St. Lawrence
Cassadaga	Chautauqua
Cayuga	Seneca, Tompkins
Champlain	Clinton, Essex, NY; Addison, Chittenden, Franklin, VT
Chautauqua	Chautauqua
Conesus	Livingston
Cross	Cayuga, Onondaga
Goodyear	Otsego
Huntington	Sullivan
Keuka	Ontario
Long	Hamilton
Lower St. Regis	Franklin
Otter	Cayuga
Owasco	Cayuga
Raquette Pond	Franklin
Round	Saratoga
Sacandaga Res.	Fulton, Saratoga
Saratoga	Saratoga
Schroon	Essex, Warren
Seneca	Seneca, Schyler, Yates
Swan	Sullivan
Swinging Bridge Res.	Sullivan


SWAN LAKE
Tributary Sampling Site
Lake Sampling Site
Sewage Treatment Facility
Direct Drainage Area Boundary
0
1Mi
Scale
41°49'
41°47'
41°45'
74°49'
74°47'
White Sulphur Springs
Loomis
A1
C1
E1
D1
B1
F1 outlet
Swan Lake
SWAN LAKE
01
Map Location
New York

SWAN LAKE

STORET NO. 3636

I. CONCLUSIONS

A. Trophic Condition:

Survey data show Swan Lake to be eutrophic. Of the 26 New York lakes sampled in the fall of 1972, 21 had less mean total phosphorus, 13 had less mean dissolved phosphorus, but none had less mean inorganic nitrogen. For all New York data, 12 lakes had less mean chlorophyll a, and 19 had greater Secchi disc transparency. High nutrient levels and heavy growths of rooted aquatic vegetation indicate lake deterioration.

B. Rate-Limiting Nutrient:

The algal assay results indicate that Swan Lake was limited by nitrogen. The ratio of nitrogen to phosphorus in sampled waters substantiate nitrogen limitation (i.e., the N/P ratio on all occasions was 13/1 or less).

C. Nutrient Controllability:

1. Point sources--During the sampling year, Swan Lake received a total phosphorus load at a rate in excess of that proposed by Vollenweider (in press) as dangerous; i.e., a eutrophic rate (see page 12). Of that load, it is estimated that the Loomis Sanitary District contributed about 26%.

The State-wide ban on phosphates in detergents may be expected to reduce the phosphrous load from the Loomis plant by

about 50%. That reduction, plus 80% removal of the remaining phosphorus at the Loomis treatment plant, would reduce the loading rate to 0.79 $g/m^2/yr$ (a mesotrophic rate) and should result in improvement of the trophic condition of Swan Lake.

2. Non-point sources (see page 12)--The phosphorus exports of the Swan Lake tributaries were quite high as compared to New York streams studied elsewhere (e.g., the mean export of four tributaries to downstream Swinging Bridge Reservoir* was 59 $lbs/mi^2/yr$). The reason for the high export rates is not apparent from the Survey data or available information.

In all, it is calculated that non-point sources contributed nearly 74% of the total phosphorus load to Swan Lake during the sampling year.

* Working Paper No. 172.

II. LAKE AND DRAINAGE BASIN CHARACTERISTICS

A. Lake Morphometry†:

1. Surface area: 332 acres.
2. Mean depth: unknown.
3. Maximum depth: >5 feet.
4. Volume: unknown.
5. Mean hydraulic retention time: unknown.

B. Tributary and Outlet:
(See Appendix A for flow data)

1. Tributaries -

Name	Drainage area*	Mean flow*
Unnamed stream (A-1)	6.6 mi^2	12.8 cfs
Unnamed stream (B-1)	0.3 mi^2	0.7 cfs
Unnamed stream (C-1)	0.6 mi^2	1.1 cfs
Unnamed stream (D-1)	1.2 mi^2	2.4 cfs
Minor tributaries & immediate drainage -	5.8 mi^2	12.4 cfs
Totals	14.5 mi^2	29.4 cfs

2. Outlet -

W. Br., Mongaup River	15.0 mi^2**	29.4 cfs

C. Precipitation***:

1. Year of sampling: 59.9 inches.
2. Mean annual: 40.0 inches.

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† Greeson and Robison, 1970.
* Drainage areas are accurate within ±5%, except for small basins (±10%); mean daily flows are accurate within ±5 to 25%; and normalized mean monthly flows are accurate within ±15%.
** Includes area of lake.
*** See Working Paper No. 1, "Survey Methods".

III. LAKE WATER QUALITY SUMMARY

Swan Lake was sampled three times during the open-water season of 1972 by means of a pontoon-equipped Huey helicopter. Each time, samples for physical and chemical parameters were collected from a number of depths at a single station on the lake (see map, page v). During each visit, a single depth-integrated (near bottom) sample was obtained from the one station for phytoplankton identification and enumeration; and during the last visit, a single five-gallon depth-integrated sample was collected for algal assays. Also each time, a depth-integrated sample was collected for chlorophyll a analysis. The maximum depth sampled was 5 feet.

The results obtained are presented in full in Appendix B, and the data for the fall sampling period, when the lake essentially was well-mixed, are summarized below. Note, however, the Secchi disc summary is based on all values.

For differences in the various parameters at the other sampling times, refer to Appendix B.

A. Physical and chemical characteristics:

Parameter	Minimum	Mean	Median	Maximum
		FALL VALUES (10/11/72)		
Temperature (Cent.)	11.8	11.8	11.8	11.8
Dissolved oxygen (mg/l)	10.0	10.0	10.0	10.0
Conductivity (μmhos)	73	76	76	78
pH (units()	7.2	7.3	7.3	7.4
Alkalinity (mg/l)	14	17	17	20
Total P (mg/l)	0.030	0.058	0.058	0.085
Dissolved P (mg/l)	0.011	0.013	0.013	0.014
$NO_2 + NO_3$ (mg/l)	0.030	0.030	0.030	0.030
Ammonia (mg/l)	0.040	0.050	0.050	0.060
		ALL VALUES		
Secchi disc (inches)	60	65	64	72

B. Biological characteristics:

1. Phytoplankton -

Sampling Date	Dominant Genera	Number per ml
05/21/72	1. Dinobryon	1,555
	2. Fragilaria	814
	3. Flagellates	723
	4. Chroococcus	470
	5. Melosira	380
	Other genera	1,230
	Total	5,172
07/22/72	1. Polycystis	334
	2. Raphidiopsis	262
	3. Schroederia	208
	4. Peridinium	190
	5. Fragilaria	181
	Other genera	941
	Total	2,116
10/11/72	1. Dinobryon	1,160
	2. Chroococcus	813
	3. Fragilaria	678
	4. Flagellates	527
	5. Melosira	407
	Other genera	1,385
	Total	4,970

2. Chlorophyll a -
(Because of instrumentation problems during the 1972 sampling, the following values may be in error by plus or minus 20 percent.)

Sampling Date	Station Number	Chlorophyll a (µg/l)
05/21/72	01	10.3
07/22/72	01	11.0
10/11/72	01	7.1

C. Limiting Nutrient Study:

1. Autoclaved, filtered, and nutrient spiked -

Spike (mg/l)	Ortho P Conc. (mg/l)	Inorganic N Conc. (mg/l)	Maximum yield (mg/l-dry wt.)
Control	0.021	0.134	3.8
0.010 P	0.031	0.134	4.1
0.020 P	0.041	0.134	3.6
0.050 P	0.071	0.134	3.8
0.050 P + 5.0 N	0.071	5.134	27.8
0.050 P + 10.0 N	0.071	10.134	26.6
10.0 N	0.021	10.134	7.1

2. Discussion -

The control yield of the assay alga, Selenastrum capricornutum, indicates that the potential primary productivity of Swan Lake was moderately high at the time of sampling. Also, the lack of increase in yield with increasing concentrations of orthophosphorus, until nitrogen was also added, indicates that the lake was limited by nitrogen at that time. Note that the addition of only nitrogen produced a yield far greater than the control.

The lake data also indicate nitrogen limitation; i.e., on all occasions, N/P ratios were 13/1 or less, and nitrogen limitation would be expected.

IV. NUTRIENT LOADINGS
(See Appendix C for data)

For the determination of nutrient loadings, the New York National Guard collected monthly near-surface grab samples from each of the tributary sites indicated on the map (page v), except for the high runoff months of April and May when two samples were collected. Sampling was begun in November, 1972, and was completed in October, 1973.

Through an interagency agreement, stream flow estimates for the year of sampling and a "normalized" or average year were provided by the New York District Office of the U.S. Geological Survey for the tributary sites nearest the lake.

In this report, nutrient loads for sampled tributaries were determined by using a modification of a U.S. Geological Survey computer program for calculating stream loadings*. Nutrient loadings for unsampled "minor tributaries and immediate drainage" ("ZZ" of U.S.G.S.) were estimated using the nutrient loads, in lbs/mi^2/year, in the unnamed stream at station B-1 and multiplying by the ZZ area in mi^2.

The community of Loomis did not participate in the Survey, and the nutrient loads were estimated at 2.5 lbs P and 7.5 lbs N/capita/year.

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* See Working Paper No. 1.

A. Waste Sources:

1. Known muncipal* -

Name	Pop. Served	Treatment	Mean Flow (mgd)	Receiving Water
Loomis SD	320	sand filter	0.032**	Unnamed stream to Swan Lake

2. Known industrial - None

* Anonymous, 1972.
** Estimated at 100 gal/capita/day.

B. Annual Total Phosphorus Loading - Average Year:

1. Inputs -

Source	lbs P/ yr	% of total
a. Tributaries (non-point load) -		
Unnamed stream (A-1)	1,000	32.6
Unnamed stream (B-1)	30	1.0
Unnamed stream (C-1)	130	4.2
Unnamed stream (D-1)	470	15.3
b. Minor tributaries & immediate drainage (non-point load) -	580	18.9
c. Known municipal -		
Loomis SD	800	26.1
d. Septic tanks* -	10	0.3
e. Known industrial - None	-	-
f. Direct precipitation** -	50	1.6
Total	3,070	100.0

2. Outputs -

Lake outlet - W. Br., Mongaup R. 2,000

3. Net annual P accumulation - 1,070 pounds

* Estimate based on 10 lakeshore dwellings; see Working Paper No. 1.
** See Working Paper No. 1.

C. Annual Total Nitrogen Loading - Average Year:

1. Inputs -

Source	lbs N/ yr	% of total
a. Tributaries (non-point load) -		
Unnamed stream (A-1)	29,500	44.8
Unnamed stream (B-1)	910	1.4
Unnamed stream (C-1)	2,490	3.8
Unnamed stream (D-1)	9,410	14.3
b. Minor tributaries & immediate drainage (non-point load) -	17,590	26.8
c. Known municipal -		
Loomis SD	2,400	3.7
d. Septic tanks* -	240	0.4
e. Known industrial -None	-	-
f. Direct precipitation** -	3,200	4.8
Total	65,740	100.0

2. Outputs -

Lake outlet - W. Br., Mongaup R. 50,050

3. Net annual N accumulation - 15,690 pounds

* Estimate based on 10 lakeside dwellings; see Working Paper No. 1.
** See Working Paper No. 1.

D. Mean Annual Non-point Nutrient Export by Subdrainage Area:

Tributary	lbs P/mi^2/yr	lbs N/mi^2/yr
Unnamed stream (A-1)	152	4,470
Unnamed stream (B-1)	100	3,033
Unnamed stream (C-1)	217	4,150
Unnamed stream (D-1)	392	7,842

E. Yearly Loading Rates:

In the following table, the existing phosphorus loading rates are compared to those proposed by Vollenweider (in press). Essentially, his "dangerous" rate is the rate at which the receiving water would become eutrophic or remain eutrophic; his "permissible" rate is that which would result in the receiving water remaining oligotrophic or becoming oligotrophic if morphometry permitted. A mesotrophic rate would be considered one between "dangerous" and "permissible".

	Total Phosphorus		Total Nitrogen	
Units	Total	Accumulated	Total	Accumulated
lbs/acre/yr	9.2	3.2	198.0	47.3
grams/m^2/yr	1.04	0.36	22.2	5.3

Vollenweider loading rates for phosphorus (g/m^2/yr) based on surface area and mean outflow of Swan Lake:

"Dangerous" (eutrophic rate)	0.84
"Permissible" (oligotrophic rate)	0.42

V. LITERATURE REVIEWED

Anonymous, 1972. Municipal S. T. W. inventory. NY State Dept. of Env. Cons., Albany.

Greeson, Phillip E., and F. Luman Robison, 1970. Characteristics of New York lakes. Part 1 - Gazateer of lakes, ponds, and reservoirs. Buil. 68, U.S. Dept. Int. and NY Dept. Env. Cons., Albany.

Vollenweider, Richard A. (in press). Input-output models. Schweiz. A. Hydrol.

VII. APPENDICES

APPENDIX A

TRIBUTARY FLOW DATA

TRIBUTARY FLOW INFORMATION FOR NEW YORK 12/30/74

LAKE CODE 3636 SWAN LAKE

MEAN MONTHLY FLOWS AND DAILY FLOWS

TRIBUTARY	MONTH	YEAR	MEAN FLOW	DAY	FLOW	DAY	FLOW	DAY	FLOW
3636C1	11	72	3.50	4	1.90				
	12	72	2.41	2	1.40				
	1	73	1.54	5	1.36	6	1.02		
	2	73	1.19	3	8.38	4	3.22		
	3	73	2.19	3	1.27				
	4	73	2.46	7	2.10	21	0.45		
	5	73	2.27	5	0.39	19	2.18		
	6	73	2.84	2	2.10				
	7	73	0.92	7	1.02				
	8	73	0.88	4	1.50				
	9	73	0.38	1	0.36				
	10	73	0.32	6	0.33				
3636D1	11	72	5.60	4	3.04				
	12	72	3.85	2	2.24				
	1	73	2.46	5	1.28	6	0.96		
	2	73	1.90	3	13.40	4	5.16		
	3	73	3.51	3	1.84				
	4	73	3.93	7	2.66	21	0.90		
	5	73	3.63	5	0.78	19	4.35		
	6	73	3.59	2	2.66				
	7	73	1.39	7	1.53				
	8	73	1.17	4	2.80				
	9	73	0.65	1	0.61				
	10	73	0.55	6	0.56				
3636F1	11	72	94.50	4	51.00				
	12	72	65.00	2	38.00				
	1	73	41.40	5	75.00	6	56.00		
	2	73	32.10	3	226.00	4	87.00		
	3	73	59.20	3	18.00				
	4	73	66.20	7	134.00	21	20.00		
	5	73	61.30	5	13.00	19	29.00		
	6	73	63.90	2	47.20				
	7	73	20.80	7	23.00				
	8	73	19.80	4	33.80				
	9	73	8.64	1	8.10				
	10	73	7.29	6	7.42				
3636Z2	11	72	39.60						
	12	72	27.30						
	1	73	17.40						
	2	73	13.50						
	3	73	24.80						
	4	73	27.80						
	5	73	25.70						
	6	73	26.80	2	19.80				
	7	73	8.72	7	9.62				
	8	73	8.29	4	14.20				
	9	73	3.62	1	3.40				
	10	73	3.86	6	3.11				

15

TRIBUTARY FLOW INFORMATION FOR NEW YORK 12/30/74

LAKE CODE 3636 SWAN LAKE

TOTAL DRAINAGE AREA OF LAKE 15.00

TRIBUTARY	SUB-DRAINAGE AREA	NORMALIZED FLOWS JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	MEAN
3636A1	6.56	11.60	11.20	24.00	29.80	14.30	7.91	5.78	6.28	6.93	8.97	13.70	13.70	12.84
3636B1	0.36	0.63	0.61	1.30	1.62	0.78	0.43	0.31	0.34	0.38	0.49	0.74	0.74	0.70
3636C1	0.57	0.98	0.95	2.04	2.52	1.22	0.67	0.49	0.53	0.59	0.76	1.16	1.16	1.09
3636D1	1.22	2.17	2.09	4.48	5.56	2.67	1.47	1.08	1.17	1.29	1.67	2.55	2.56	2.40
3636F1	15.00	26.60	25.60	54.90	9.20	32.80	18.10	13.20	14.40	15.90	20.50	31.30	31.40	29.40
3636ZZ	6.29	11.20	10.80	23.00	8.60	13.80	7.58	5.55	6.03	6.65	8.60	13.10	13.20	12.34

SUMMARY

TOTAL DRAINAGE AREA OF LAKE = 15.00
SUM OF SUB-DRAINAGE AREAS = 15.0)

TOTAL FLOW IN = 352.48
TOTAL FLOW OUT = 352.90

MEAN MONTHLY FLOWS AND DAILY FLOWS

TRIBUTARY	MONTH	YEAR	MEAN FLOW	DAY	FLOW	DAY	FLOW	DAY	FLOW
3636A1	11	72	41.30	4	22.00				
	12	72	28.40	2	16.00				
	1	73	18.10	5	20.00	6	14.80		
	2	73	14.00	3	99.00	4	38.00		
	3	73	25.90	3	6.80				
	4	73	29.00	7	30.00	21	6.60		
	5	73	26.80	5	6.80	19	44.00		
	6	73	28.40	2	21.00				
	7	73	5.85	7	6.46				
	8	73	4.69	4	12.00				
	9	73	0.38	1	0.36				
	10	73	0.27	6	0.27				
3636B1	11	72	2.24	4	1.22				
	12	72	1.54	2	0.90				
	1	73	0.98	5	1.20	6	9.00		
	2	73	0.76	3	54.00	4	2.06		
	3	73	1.40	3	0.42				
	4	73	1.57	7	2.24	21	0.48		
	5	73	1.45	5	0.42	19	2.32		
	6	73	0.47	2	0.35				
	7	73	0.25	7	0.27				
	8	73	0.26	4	0.45				
	9	73	0.12	1	0.11				
	10	73	0.10	6	0.10				

APPENDIX B

PHYSICAL and CHEMICAL DATA

STORET RETRIEVAL DATE 74/11/26

363601
41 45 40.0 074 48 10.0
SWAN LAKE
36 NEW YORK

11EPALES 2111202
3 0008 FEET DEPTH

DATE FROM TO	TIME OF DAY	DEPTH FEET	00010 WATER TEMP CENT	00300 DO MG/L	00077 TRANSP SECCHI INCHES	00094 CNDUCTVY FIELD MICROMHO	00400 PH SU	00410 T ALK CACO3 MG/L	00630 NO2&NO3 N-TOTAL MG/L	00610 NH3-N TOTAL MG/L	00665 PHOS-TOT MG/L P	00666 PHOS-DIS MG/L P
72/05/21	13 25	0000	18.1	9.5	64	70	6.70	12	0.050	0.070	0.054	0.011
	13 25	0005	16.6	7.4		65	6.40	10	0.060	0.130	0.029	0.014
72/07/22	12 05	0000			60	80	7.20	19	0.050	0.110	0.041	0.028
	12 05	0004	27.6	6.9		70	7.20	17	0.050	0.080	0.044	0.023
72/10/11	15 00	0000			72	78	7.35	20	0.030	0.040	0.030	0.011
	15 00	0004	11.8	10.0		73	7.20	14	0.030	0.060	0.085	0.014

DATE FROM TO	TIME OF DAY	DEPTH FEET	32217 CHLRPHYL A UG/L
72/05/21	13 25	0000	10.3J
72/07/22	12 05	0000	11.0J
72/10/11	15 00	0000	7.1J

J VALUE KNOWN TO BE IN ERROR

APPENDIX C

TRIBUTARY DATA

STORET RETRIEVAL DATE 74/11/26

3636A1 LS3636A1
41 47 30.0 074 49 00.0
UNNAMED CREEK
36 7.5 LIBERTY WEST
I/SWAN LAKE
TOWNSEND RD BRDG
11EPALES 2111204
4 0000 FEET DEPTH

DATE FROM TO	TIME OF DAY	DEPTH FEET	00630 NO2&NO3 N-TOTAL MG/L	00625 TOT KJEL N MG/L	00610 NH3-N TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P	00665 PHOS-TOT MG/L P
72/11/04	11 40		0.140	0.420	0.052	0.011	0.040
72/12/02	10 30		0.400	0.250	0.011	0.009	0.013
73/01/03	11 10		0.410	0.720	0.190	0.042	0.100
73/01/06	09 45		0.450	0.240	0.016	0.008	0.011
73/03/03	10 50		0.590	1.380	0.760	0.025	0.080
73/04/07	10 00		0.400	0.330	0.021	0.005K	0.030
73/04/21	10 15		0.280	1.380	0.046	0.007	0.030
73/05/05	09 15		0.260	0.255	0.020	0.008	0.025
73/05/19	11 00		0.200	0.340	0.015	0.009	0.030
73/06/02	10 00		0.170	2.200	0.063	0.010	0.030
73/07/07	11 00		0.198	3.100	0.072	0.017	0.045
73/08/04	10 20		0.150	0.600	0.040	0.027	.0.055
73/09/01	10 50		0.270	0.320	0.040	0.017	0.035
73/10/06	11 00		0.115	0.990	0.060	0.022	0.045

K VALUE KNOWN TO BE LESS THAN INDICATED

STORET RETRIEVAL DATE 74/11/26

363681 LS363681
41 45 30.0 074 48 30.0
UNNAMED CREEK
36 7.5 LIBERTY WEST
T/SWAN LAKE
BANK OF LGT DUTY RD NEAR GRAVEL PITS
11EPALES 2111204
4 0000 FEET DEPTH

DATE FROM TO	TIME OF DAY	DEPTH FEET	00630 NO2&NO3 N-TOTAL MG/L	00625 TOT KJEL N MG/L	00610 NH3-N TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P	00665 PHOS-TOT MG/L P
72/12/02	11	40	0.261	0.110	0.071	0.007	0.007
73/01/06	10	30	0.240	0.160	0.011	0.005K	0.010
73/02/03	11	55	0.290	0.300	0.033	0.013	0.030
73/03/03	11	35	0.540	0.110	0.030	0.010	0.020
73/04/07	12	20	0.087	0.270	0.046	0.005K	0.030
73/04/21	12	30	0.066	1.890	0.062	0.008	0.045
73/05/05	10	10	0.170	0.120	0.007	0.008	0.015
73/05/19	13	00	0.044	0.110	0.005K	0.007	0.025
73/06/02	12	30	0.037		0.160	0.006	0.025
73/07/07	13	10	0.037	2.200	0.061	0.008	0.020
73/08/04	12	30	0.019	0.200	0.013	0.009	0.015
73/09/01	13	10	0.176	0.100K	0.006	0.011	0.045
73/10/06	13	20	0.138	0.390	0.042	0.008	0.035

K VALUE KNOWN TO BE LESS THAN INDICATED

21

STORET RETRIEVAL DATE 74/11/26

3636C1 LS3636C1
41 46 30.0 074 47 30.0
UNNAMED CREEK
36 7.5 LIBERTY
T/SWAN LAKE
LAKE MARIE RD BRDG
11EPALES 2111204
4 0000 FEET DEPTH

DATE FROM TO	TIME OF DAY	DEPTH FEET	00630 NO2&NO3 N-TOTAL MG/L	00625 TOT KJEL N MG/L	00610 NH3-N TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P	00665 PHOS-TOT MG/L P
72/11/04	11 55		0.034	0.500	0.052	0.005K	0.026
72/12/02	10 40		0.096	0.380	0.027	0.005K	0.028
73/01/06			0.147	0.940	0.077	0.005K	0.008
73/02/03	11 20		0.210	0.460	0.105	0.014	0.055
73/03/03	11 00		0.110	0.165	0.126	0.007	0.030
73/04/07	10 20		0.120	0.320	0.020	0.005K	0.020
73/04/21	10 35		0.027	1.150	0.044	0.005K	0.020
73/05/05	09 25		0.015	0.900	0.031	0.005K	0.015
73/05/19	11 30		0.050	2.800	0.092	0.015	0.080
73/06/02	10 00		0.013	0.930	0.021	0.019	0.070
73/07/07	11 20		0.013	3.950	0.154	0.056	0.350
73/08/04	11 20		0.019	0.580	0.027	0.005K	0.040
73/09/01	11 10		0.025	0.770	0.078	0.006	0.060
73/10/06	11 20		0.063	1.210	0.400	0.005K	0.040

K VALUE KNOWN TO BE LESS THAN INDICATED

STORET RETRIEVAL DATE 74/11/26

363601 LS363601
41 45 00.0 074 47 00.0
UNNAMED CREEK
36 7.5 LIBERTY WEST
T/SWAN LAKE
BANK OFF RD OUT OF TOWN OF SWAN LAKE
11EPALES 2111204
4 0000 FEET DEPTH

DATE FROM TO	TIME OF DAY	DEPTH FEET	00630 NO2&NO3 N-TOTAL MG/L	00625 TOT KJEL N MG/L	00610 NH3-N TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P	00665 PHOS-TOT MG/L P
72/11/04	12 35		0.820	0.720	0.074	0.010	0.066
72/12/02	11 20			0.270	0.028	0.015	0.032
73/01/06			2.100	0.130	0.026	0.019	0.031
73/02/03	11 20		1.300	0.650	0.105	0.046	0.130
73/03/03	11 20		2.100	0.340	0.138	0.029	0.070
73/04/07	11 25		1.260	0.400	0.042	0.020	0.050
73/04/21	11 30		1.000	1.050	0.032	0.015	0.080
73/05/05	09 50		0.990	1.000	0.038	0.013	0.095
73/05/19	12 10		0.790	1.800	0.098	0.025	0.095
73/06/02	11 00		0.450	2.600	0.038	0.024	
73/07/07	12 30		0.250	1.800	0.072	0.031	0.120
73/08/04	11 45		0.390	0.615	0.029	0.026	0.085
73/09/01	12 15		0.010K	1.680	0.023	0.026	0.290
73/10/06	12 35		0.140	1.760	0.115	0.015	0.180

STORET RETRIEVAL DATE 74/11/26

3636E1 LS3636E1
41 47 00.0 074 47 30.0
UNNAMED STREAM
36 7.5 LIBERTY WEST
T/SWAN LAKE
ALONG BANK 4ELO STP
11EPALES 2111204
4 0000 FEET DEPTH

DATE FROM TO	TIME OF DAY	DEPTH FEET	00630 NO2&NO3 N-TOTAL MG/L	00625 TOT KJEL N MG/L	00610 NH3-N TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P	00665 PHOS-TOT MG/L P
72/11/04	12 10		1.200	0.650	0.357	0.294	0.336
72/12/02	10 55			0.330	0.140	0.105	0.132
73/02/03	13 30		0.540	0.840	0.300	0.198	0.270
73/03/03	12 10		0.730	1.600	1.100	0.520	0.630
73/04/07	11 00		0.420	0.460	0.132	0.132	0.165
73/04/21	11 00		0.470	1.200	0.140	0.260	0.315
73/05/05	09 40		0.540	0.600	0.138	0.200	0.220
73/05/19	12 00		0.340	2.940	0.310	0.126	0.180
73/06/02	11 00		0.400	2.900	0.540	0.410	0.500
73/07/07	12 00		0.294	0.250	0.019	0.160	0.190
73/08/04	11 20		0.930	1.000	0.490	0.500	0.570
73/09/01	11 40		0.810	1.400	0.380	0.590	0.790
73/10/06	11 55		3.800	1.700	0.070	0.900	1.100

STORET RETRIEVAL DATE 74/11/26

3636F1 LS3636F1
41 45 00.0 074 47 00.0
UNNAMED STREAM
36 7.5 LIBERTY WEST
T/SWAN LAKE
CO HWY 142 HRDG
11EPALES 2111204
4 0000 FEET DEPTH

DATE FROM TO	TIME OF DAY	DEPTH FEET	00630 NO2&NO3 N-TOTAL MG/L	00625 TOT KJEL N MG/L	00610 NH3-N TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P	00665 PHOS-TOT MG/L P
72/11/04	12 00		0.053	0.520	0.044	0.005K	0.044
73/01/06	10 15		0.399	0.370	0.025	0.007	0.017
73/02/03	11 45		0.380	0.580	0.051	0.007	0.035
73/03/03	11 30		0.340	0.210	0.035	0.007	0.037
73/04/07	12 00		0.176	0.420	0.013	0.005K	0.025
73/04/21	12 00		0.071	0.880	0.023	0.005K	0.025
73/05/05	10 00		0.020	0.350	0.006	0.005K	0.030
73/05/19	12 40		0.022	1.500	0.054	0.009	0.035
73/06/02	12 00		0.015	1.380	0.048	0.010	0.030
73/07/07	12 45		0.010K	1.470	0.027	0.014	0.040
73/08/04	12 10		0.010K	0.780	0.021	0.005K	0.055
73/09/01	13 45		0.011	0.500	0.044	0.007	0.035
73/10/06	13 00		0.014	0.660	0.033	0.005K	0.035